PB82-259102

Railroad Cash Flow Model Software Documentation
Volume 1: Cash Flow Model Description

Energy Resources Co, Inc.
Vienna, VA

Prepared for

Environmental Protection Agency
Washington, DC

Jan 82

U.S. Department of Commerce
National Technical Information Service
NTIS

PB82-259102

EPA 550/9-82-204-A

RAILROAD CASH FLOW MODEL
SOFTWARE DOCUMENTATION

VOLUME 1

CASH FLOW MODEL DESCRIPTION

January 1982

U.S. Environmental Protection Agency
Washington, D.C. 20460

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

SOE.6 C1

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA 550/9-82-204-A	2.	3. Recipient's Accession No. PB82 259102
4. Title and Subtitle Rairoad Cash Flow Model - Volume 1: Cash Flow Model Description			5. Report Date January 1982 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Energy Resources Co., Inc. 8290-B Old Courthouse Road Vienna, Virginia 22180			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) EPA 68-01-6093 (G)
12. Sponsoring Organization Name and Address Office of Noise Abatement and Control U.S. Environmental Protection Agency Washingon, D.C 20460			13. Type of Report & Period Covered Final 14.

15. Supplementary Notes Reports describing the Railyard Noise Exposure Model (RYNEM) and the Railyard Noise Exposure Model - Source Busmodel (RYNEM-S) are available from NTIS. A computer tape containing all of the related Railyard/Railroad Noise Models is available from NTIS.

16. Abstract (Limit: 200 words)

This document describes the cash flow model used in the financial analysis conducted for the background document to railroad yard noise standards. It first details the purpose of the cash flow model. Next, a derivative to the equations used in the model is presented. Volume II lists the data inputs needed to use the model. Finally, a sample output of the model is shown with notes on how to interpret it.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement: Release Unlimited	19. Security Class (This Report) Unclassified	21. No. of Pages
	20. Security Class (This Page) Unclassfied	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

ATTENTION

PORTIONS OF THIS REPORT ARE NOT LEGIBLE.
HOWEVER, IT IS THE BEST REPRODUCTION
AVAILABLE FROM THE COPY SENT TO NTIS.

RAILROAD CASH FLOW MODEL
SOFTWARE DOCUMENTATION

VOLUME 1

CASH FLOW MODEL DESCRIPTION

January 1982

Office of Noise Abatement and Control
U.S. Environmental Protection Agency
Washington, D.C. 20460

This report has been approved for general availability. The contents of this report reflect the views of the contractor, who is responsible for the facts and the accuracy of the data presented herein, and do not necessarily reflect the official views or policy of EPA. This report does not constitute a standard, specification, or regulation. Permission is granted to reproduce this material without further clearance.

TABLE OF CONTENTS

	Section	Page
1.1	Introduction	1-1
1.2	Cash Flow Model	1-1
1.3	Operation of the Model	1-3
1.4	Data Inputs	1-11
1.5	Model Outputs	1-12
1.6	Example of Use of Cash Flow Model	1-29

Figures

1-1	Flow Chart of Cash Flow Model	1-6

Appendix A: Errata Sheets 1-39

VOLUME ONE

DESCRIPTION OF THE CASH FLOW MODEL

1.1 Introduction

This document describes the cash flow model used in the financial analysis conducted for the background document to railroad yard noise standards. It first details the purpose of the cash flow model. Next, a derivation of the equations used in the model is presented. A subsequent section lists the data inputs needed to use the model. Finally, a sample output of the model is shown with notes on how to interpret it.

1.2 Cash Flow Model

The methodology of the cash flow model of the railyard noise standards background document is similar to that of a previous study for EPA-ONAC (Background Document for Final Rail Carrier Noise Emissions: Source Standards, December 1979). Use was also made of EPA formats designed to determine if a firm was entitled to a variance to Section 301(c) standards under the Clean Water Act. Thus an attempt was made to use a methodology consistent with similar analysis made for EPA.

The cash flow model studies whether a firm's net assets are earning their opportunity cost. The opportunity cost of a firm's assets is usually defined as the cost of the capital invested in them. If the firm's net assets are not

generating enough income to cover their opportunity cost, it has lost the economic rationale of its existence. The firm should liquidate its assets and reinvest its capital elsewhere at higher rates of return. If the cash flow analysis suggests that the firm's net assets are not earning their opportunity costs, then obviously the firm is having serious financial problems.

The cash flow analysis operates by subtracting the net worth (NW) of each railroad from its discounted present value of future cash flows (DCF). The NW of the firm is the original cost of its net assets less depreciation. The firm's DCF is equal to the sum of its yearly cash flows over the appropriate time period, discounted by the opportunity cost of capital. DCF, then, is the present value of the cash a firm's net assets will generate. If a firm's net assets are earning their opportunity cost or more, the firm's DCF will exceed its NW. The difference between DCF and NW is a positive number. If the firm's net assets are not earning their opportunity cost, the difference will be negative. The difference between DCF and NW will be refered to as the Net Present Value of Future Cash Flows (NPV).

The cash flow model allows NPV to be computed both before and after regulation to determine the magnitude of the regulatory burden. (It calculates NPV for one scenario at a time, however.) The compliance expenditures affect the net present value of the firm's future cash flow through their effect on railway net income. The compliance expenditures also increase the net asset value of the firm, and thus the opportunity cost of its assets.

In order to provide a common measure for comparisons of the financial health of firms of different sizes, the NPV of

each firm can be divided by its NW. The resulting ratio allows firms of different sizes to be compared according to their financial health. Changes in the ratio after regulation provide a measure of the compliance burden which is comparable across firms.

The following broad categories were used to evaluate firms according to their ratio of NPV/NW.

(a) Weak Firms - If the NPV/NW < 0, the firm is in extremely weak financial condition. Noise abatement expenditures will worsen (if the ratio is < 0 before regulation) or create (if the ratio is < 0 only after regulation) a tenuous financial condition.

(b) Marginal Firms - If 0 < NPV/NW < 0.1 before or after abatement expenditures, then the firm may suffer financial difficulties as a result of regulation. The firm would be extremely sensitive to any downturn in economic activity.

(c) Stronger Firms - If NPV/NW > 0.1 after abatement, the firm has a reasonably sound financial basis. Regulation would not be expected to cause major financial problems.

The cash flow analysis is set up to calculate DCF using three unique data sets for cash flow. Use of three data sets instead of one helps to ensure that the results of the cash flow model fairly reflect firm financial conditions.

(a) Historical Cash Flows: In this analysis, it is assumed that railroad cash flows are constant over time. The average cash flow for the period 1973-1978 (in constant 1980 dollars) is calculated for each firm. Future cash flows over the time horizon of the project are assumed equal to this historical average.

(b) Baseline Forecast Cash Flows: In this data set, firm cash flows grow over time in proportion to

the industry baseline forecast. Because the baseline forecast projects industry growth over time, firm finances appear stronger in the derived forecast than in the historical forecast.

(c) Profit-Maximizing Cash Flows: In this analysis, too, railroad cash flows grow over time in proportion to the baseline industry forecast. The analysis of compliance impacts is included by using the results of the profit-maximizing model to estimate changes in cash flow due to regulation.

The alternative formulations were deemed necessary as checks against each other, given the potential inaccuracies of cash flow projections. The baseline forecast analysis, by incorporating expected growth for the industry, is a viable approach. The profit-maximization approach incorporates both expected growth for the industry and price/output changes due to regulation. However, the historical analysis works as a check to insure that the growth forecasts do not obscure the weakness of current industry finances by assuming considerable growth over the long time period considered.

1.3 Operation of the Model

The cash flow model operates quite simply. It reads in data from a number of files.[1] Various calculations are performed on the data and the results are printed. The discrete steps the model performs are shown in Figure 1-1. As this flowchart shows, the cash model merely manipulates data and does not interpret any results.

The main result of the model, the ratio of DCF to NW for each firm, is determined through a series of equations which may be summarized in the following expression:

---

[1]These data requirements are described in the next section.

$$NPV/NW = (DCF - PVINV + PVDEP - PVOM - NW)/NW$$

where,

- NPV is the net present value of future cash flows
- DCF is the present value of future cash flows
- PVINV is the present value of investment in noise abatement equipment
- PVDEP is the present value of tax advantages accruing because of depreciation on the equipment
- PVOM is the present value of operating and maintenance expenses
- NW is the net worth of the firm.

NPV is the net present value of future cash flows, calculated as the difference between the present value of the firm's future cash flows and the sum of the present value of the firm's net expenditures on abatement equipment and maintenance costs (after taxes) and the firm's net worth.

DCF is the present value of the firm's cash flows over the time horizon of the project. Cash flow is defined as follows:

In the historical cash flow approach, the firm's cash flow was assumed constant over time. Cash flow was based on 1973 to 1978 average cash flow (corrected to 1980 dollars) where cash flow was defined as follows:

$$CF = NI + DEFT + EQ$$

where:

- CF is cash flow
- NI is net income

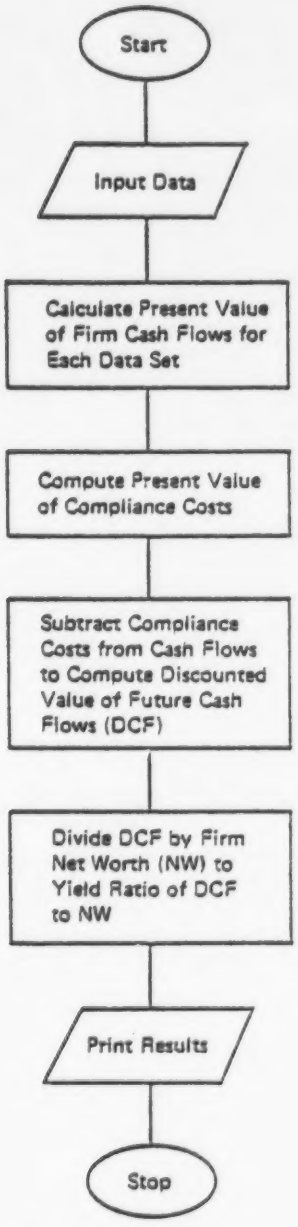
Start
Input Data
Calculate Present Value of Firm Cash Flows for Each Data Set
Compute Present Value of Compliance Costs
Subtract Compliance Costs from Cash Flows to Compute Discounted Value of Future Cash Flows (DCF)
Divide DCF by Firm Net Worth (NW) to Yield Ratio of DCF to NW
Print Results
Stop

Figure 1–1. Flow chart of cash flow model.

- DEFT is deferred taxes
- EQ is equity in earnings of affiliates.

Depreciation was not added back into historical cash flow because it was assumed depreciation would be used to replace existing capital. The historical cash flow approach is the same as the one used in earlier background documents.

Forecasted Cash Flow

Because the baseline and derived forecasts provide only net income forecasts and not forecasts for the other accounts in cash flow, some method is needed to convert net income to cash flows. For the two forecasted data sets, baseline and derived forecast, net income is converted to cash flows as follows:

$$CF = NI \cdot \frac{AVGCF_{73-78}}{AVGNI_{73-78}}$$

where:

- CF is cash flow
- NI is firm net income from the forecast
- $AVGCF_{73-78}$ is average cash flow over the 1973 to 1978 period
- $AVGNI_{73-78}$ is average net income over the 1973 to 1978 period.

CF (cash flow) is derived by multiplying NI (net income) by the average ratio of cash flow to net income over the historical period. Since the components of cash flow

other than NI are not available, multiplying NI by the ratio of CF to NI was chosen as an appropriate method of converting NI to CF.

Present value of the firm's future cash flows was determined according to the formula

$$DCF = \sum_{t=0}^{LIFE-1} \frac{(CF_t)(1+INFLATION)^t}{(1+DISCOUNT)^t}$$

where:

- DCF is the present value of future cash flows
- LIFE is the time horizon of the project
- INFLATION is the assumed rate of inflation.
- DISCOUNT is the opportunity cost of capital to the railroad.
- CF_t is the cash flow in period t. In the historical case, CF_t was equal to the 1973-1978 average cash flow expressed in 1980 dollars. In the baseline forecast, CF_t is equal to the firm projected cash flow for that year. In the post-regulatory derived forecast, CF_t is the post-compliance cash flow for that year derived from the projections of net income yielded by the profit-maximization model and the baseline forecast. Under the scenario of no regulation, the baseline forecast cash flow will equal cash flows calculated using the profit-maximization derived forecast.

PVINV is the present value of investment on abatement equipment, defined as:

$$PVINV = \sum_{t=0}^{LIFE} \sum_{j=1}^{i} \frac{COST_j(1+INFLATION)^t(1-ITC)}{(1+DISCOUNT)^t}$$

where:

- $COST_j$ is the cost of abatement item j.
- ITC is the federal investment tax credit, assumed to be taken in the year the investment is made.

PVDEP is the present value of depreciation, assumed to be straight-line. Because depreciation is not a cash outflow, but is tax deductible, it adds to the cash flow of the firm. Thus, the tax savings accruing because of depreciation on abatement equipment were added back to the present value of the firm's cash flow according to the formula:

$$PVDEP = \sum_{t=TIME}^{LIFE-1} \sum_{j=1}^{i} \frac{C_j \quad (TAX)}{T_j \ (1+DISCOUNT)^t}$$

where:

- PVDEP is the present value of depreciation expenses.
- T_j is the service life of item j.
- C_j is the cost of each of i items of abatement equipment. C_j is assumed to be the 1980 cost of each item from 1980 until the year the item is scheduled to wear out. Service lives vary between 10 years for local sound barriers for idling locomotives to an infinite period for land purchases. After the service life is over, C_j is multiplied by one plus the inflation rate raised to the power of the service life. At the end of the replacement item's service life, the cost of the replacement item is inflated as above to obtain the newest item's cost. This process is repeated as often as necessary. For example, assuming a 25-year time horizon, an item with a 10-year service life must be purchased three times -- at the beginning of the project, in the 11th year of the project and in the 21st year of the project. If the project begins in 1980, the item's cost will be in 1980 dollars for 1980-1989, 1990 dollars for 1990-1999, and 2000 dollars for 2000-2004.

This inflation of each item's cost at the end of its service life reflects the fact that depreciation is calculated as a proportion of purchase cost, not replacement cost.

- TIME is the difference between the implementation year and 1980.

PVOM is the present value of operating and maintenance expenses of the abatement equipment. These expenses are tax-deductible and the firm must bear only a portion of them. PVOM was derived as follows:

$$PVOM = \sum_{t=0}^{LIFE-1} O\&M_t \quad \frac{(1+INFLATION)^t(1-TAX)}{(1+DISCOUNT)^t}$$

where:

- PVOM is the present value of operating and maintenance expenses
- $O\&M_t$ are operating and maintenance expenses in the period t.

NW is the net worth of the firm, also known as the stockholders' equity or net investment. The net worth used was a straight-line extrapolation of 1973-1978 growth in net worth to 1980, made according to the formula:

$$NW_{1980} = [(NW_{1978} - NW_{1973})/5] \times 2 + NW_{1978}$$

where:

- NW_{1980} is 1980 net worth.
- NW_{1978} is 1978 net worth.
- NW_{1973} is 1973 net worth.
- $(NW_{1978} - NW_{1973})/5$ represents the average growth in net worth over the 1973-1978 period.

The model also calculates initial investment costs for each firm by multiplying the compliance cost per yard type by the number of each yard type owned by each firm. The formula is as follows:

$$\text{Investment}_{\text{Firm}} = \sum_{\text{Yard}=1}^{4} \text{Cost}_{\text{Yard}} \cdot \text{Number}_{\text{Yard}}$$

where:

- $\text{Investment}_{\text{Firm}}$ is the initial investment by firms
- $\text{Cost}_{\text{Yard}}$ is the initial investment cost by yard type: hump, flat classification, flat industrial, and small industrial.
- $\text{Number}_{\text{Yard}}$ is the number of each yard type owned by the railroad.

1.4 Data Inputs

The operation of the cash flow model is dependent on a number of data files. These data files contain all the key parameters and inputs of the model. Because these parameters are easily accessed through the data files, the model is easily updated and changed. The data requirements of the model are:

(a) Gross National Product Deflators for 1973 to 1980. These deflators allow correction of nominal historical dollar amounts to 1980 dollar amounts.

(b) Historical financial data for each firm. A base historical period of 1973 to 1978 was chosen. From this period, historical cash flows and firm net worth are derived. The historical financial data must include firm net income, deferred taxes, equity in earnings of affiliates and net worth for each year from 1973 to 1978.

(c) Yard inventory. The number of each type of yard owned by each firm.

(d) Yard investment costs. The present value of depreciation over the life of the project, by type of yard, the present value of investment costs by yard type and the initial investment cost by yard type are needed.

(e) Net income forecasts. Forecasts for net income are needed, by firm, under the baseline forecast and the profit-maximization derived forecast. A forecast is needed for at least two years, 1980 and the terminal year of the project time horizon (2000 or 2010, for example). The model automatically calculates net income forecasts for intervening years by linear interpolation.

(f) Miscellaneous parameters. The model also requires certain parameters. These are: the investment tax credit, corporate tax rate, project implementation year, the discount rate, the inflation rate and the number of firms in the data set.

1.5 Model Outputs

The cash flow model produces six distinct sets of results. These results are very easily interpreted.

The first set of results, marked "A" on the attached copy of the model output, simply reproduces the parameters used in the model. Each parameter appears below or next to its title. For example, .08 appears next to "Inflation rate" indicating 8 percent inflation is assumed within the model. 40 appears below "Number of Firms" to indicate there are 40 firms in the sample set. Other parameters are the corporate tax rates, the investment tax credit, discount rate, time horizon and implementation year.

The next set of results, marked "B", in the attached copies of the output, are intermediate results of the analysis. These intermediate results include present discounted values of the post-regulatory investment cost, operating and maintenance expenses, the tax savings because of depreciation, and cash flows under each of the three data sets described above. To save programming time, each firm was assigned a number. This number is printed instead of the firm's name. This number appears in the first column of output in each set of firm-specific results.

The correspondence of each firm to its number is shown in the list below:

1. Atchison, Topeka and Santa Fe
2. Baltimore and Ohio
3. Bessemer and Lake Erie
4. Boston and Maine
5. Burlington Northern
6. Chesapeake and Ohio
7. Chicago and North Western
8. Chicago, Milwaukee, St. Paul and Pacific
9. Chicago, Rock Island, and Pacific
10. Clinchfield
11. Colorado and Southern
12. Conrail
13. Delaware and Hudson
14. Denver and Rio Grande Western
15. Detroit, Toledo, and Ironton
16. Duluth, Misabe, and Iron Range
17. Elgin, Joliet, and Eastern
18. Florida East Coast
19. Fort Worth and Denver
20. Grand Trunk Western
21. Illinois Central Gulf
22. Kansas City Southern
23. Long Island Railroad
24. Louisville and Nashville
25. Missouri Pacific
26. Missouri-Kansas-Texas
27. Norfolk and Western
28. Pittsburgh and Lake Erie
29. St. Louis - San Francisco

30. St. Louis - Southwestern
31. Seaboard Coast Line
32. Soo Line
33. Southern Pacific
34. Union Pacific
35. Western Maryland
36. Western Pacific
37. Alabama Great Southern
38. Central of Georgia
39. Cincinnati, New Orleans, Texas Pacific
40. Southern Railway

For example, firm 1 is the Atchison, Topeka and Santa Fe. The present value of its investment costs are $41.074 million.

The next set of results, marked "C", is a firm-specific list of the net worth base used by the model. This net worth is a straight-line extrapolation of 1973 to 1978 trends in firm net worth to 1980. This extrapolation of net worth was made to allow for a realistic 1980 net worth to use in the model. Actual 1980 net worth data was not available.

The next set of results, marked "D", is quite large. It is a firm specific compilation of the net present value of future cash flows (DCF) before and after regulation. It also shows the change in DCF due to regulation. DCF is shown under all three assumptions about the basis for cash flows (historical, baseline forecast, and "profit-maximization" forecast).

The section of results marked "E" shows the most important results of the cash flow model. These are firm-specific ratios of DCF to NW under the three assumptions about cash flows. These ratios are for firms after compliance. Pre-compliance ratios can be obtained by running the

model with zero compliance costs. Firms with an asterisk in their ratio columns had zero or negative net worth. As a result, the ratio of DCF to NW for these firms is meaningless.

The final set of results, marked "F", present firm-specific initial compliance costs. A total for all firms is shown at the bottom of the column.

The results attached are illustrative only.

NUMBER OF FIRMS: 40 | TIME HORIZON OF PROJECT: 31 | IMPLEMENTATION YEAR: 4

TAX RATE: 0.460 | ITC: 0.100 | DISCOUNT RATE: 0.110 | INFLATION RATE: 0.080

A

B

INTERMEDIATE RESULTS

FIRM	PRESENT VALUE OF INVESTMENT COST **********	PRESENT VALUE OF OPERATING MAINTENANCE **********	PRESENT VALUE OF DEPRECIATION **********	PRESENT VALUE OF CASH FLOW		
				HISTORICAL *********	BASELINE ********	FORECAST ********
1	11.074	0.0	6.406	2113.365	6671.520	6671.531
2	44.160	0.0	5.891	1435.444	3052.757	3052.765
3	1.693	0.0	0.237	162.327	1289.616	1289.618
4	5.062	0.0	0.795	-178.698	172.555	172.555
5	69.691	0.0	10.938	2016.035	6267.152	6267.172
6	29.436	0.0	4.522	1392.955	1328.882	1328.887
7	34.989	0.0	5.269	-91.170	1920.159	1920.173
8	0.0	0.0	0.0	-707.591	-658.010	-658.004
9	0.0	0.0	0.0	-766.032	433.353	433.357
10	0.0	0.0	0.0	0.0	221.141	221.141
11	2.404	0.0	0.384	67.346	181.646	181.647
12	166.281	0.0	26.182	-10053.980	-7335.027	-7334.980
13	1.660	0.0	0.694	-118.530	-24.259	-24.258
14	6.663	0.0	1.102	618.619	1402.818	1402.824
15	3.139	0.0	0.505	56.057	137.956	137.957
16	1.952	0.0	0.295	233.669	589.426	589.427
17	3.196	0.0	0.561	406.307	586.807	586.807
18	1.965	0.0	0.297	250.436	604.992	604.992
19	2.532	0.0	0.381	36.887	260.143	260.144
20	5.479	0.0	0.0	121.750	530.750	530.750
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reproduced from best available copy.

22	5.974	0.0	0.929	187.787	1148.296	1148.298
23	1.414	0.0	0.231	31.157	6.217	6.217
24	23.388	0.0	3.696	701.941	1867.939	1867.954
25	41.761	0.0	6.560	2099.230	6172.723	6172.715
26	0.053	0.0	1.230	-150.613	275.878	275.880
27	45.093	0.0	6.935	3655.620	6924.161	6924.181
28	3.160	0.0	0.488	258.002	366.863	366.863
29	17.070	0.0	2.728	453.035	1476.152	1476.160
30	6.498	0.0	0.997	1233.789	1531.998	1532.004
31	34.406	0.0	5.457	1874.126	2644.274	2644.281
32	10.681	0.0	1.590	506.293	1526.919	1526.923
33	45.820	0.0	7.520	2447.306	5231.496	5231.508
34	30.874	0.0	4.937	3996.517	9412.730	9412.734
35	5.797	0.0	0.928	147.458	327.408	327.409
36	4.164	0.0	0.659	-386.232	-2539.277	-2539.275
37	0.0	0.0	0.0	245.927	583.017	583.017
38	6.265	0.0	1.047	577.608	1349.726	1349.727
39	0.322	0.0	0.055	0.0	849.658	849.658
40	33.180	0.0	5.371	2064.980	3518.284	3518.288

1978 NET WORTH EXTRAPOLATED TO 1980

FIRM	NET WORTH (MILLIONS)
1	1411.519
2	829.821
3	125.029
4	0.0
5	2085.906
6	816.847
7	28.038
8	150.841
9	23.956
10	0.0
11	86.690
12	-320.456
13	5.186
14	227.187
15	42.747
16	74.036
17	89.628
18	126.491
19	43.105
20	411.659
21	658.018
22	131.693
23	0.0
24	474.847
25	800.311
26	-42.264
27	1255.226
28	150.625
29	233.038
30	265.976
31	1195.305
32	184.147
33	1555.780
34	1389.143
35	85.836
36	41.695
37	92.891
38	224.676
39	0.0
40	1333.361

Reproduced from best available copy.

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
1	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	1001.843	5220.000	NOT APPLICABLE
1	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	967.177	5225.320	5225.340
1	CHANGE	34.668	34.672	NOT APPLICABLE
2	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	605.623	2222.936	NOT APPLICABLE
2	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	568.345	2185.458	2185.667
2	CHANGE	37.278	37.278	NOT APPLICABLE
3	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	37.298	1164.587	NOT APPLICABLE
3	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	35.842	1163.131	1163.133
3	CHANGE	1.455	1.456	NOT APPLICABLE
4	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-178.698	172.555	NOT APPLICABLE
4	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-182.966	168.287	168.288
4	CHANGE	4.268	4.268	NOT APPLICABLE
5	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-70.872	1180.246	NOT APPLICABLE
5	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-129.495	1121.623	1121.512
5	CHANGE	58.623	58.624	NOT APPLICABLE

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
6	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	546.109	181.036	NOT APPLICABLE
6	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	521.194	457.121	457.136
6	CHANGE	24.915	24.915	NOT APPLICABLE
7	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	119.208	1892.121	NOT APPLICABLE
7	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-148.929	1862.400	1862.414
7	CHANGE	29.721	29.721	NOT APPLICABLE
8	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-860.432	-818.851	NOT APPLICABLE
8	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-860.432	-818.851	-818.845
8	CHANGE	0.0	0.0	NOT APPLICABLE
9	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-789.989	409.396	NOT APPLICABLE
9	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-789.989	409.396	409.401
9	CHANGE	0.0	0.0	NOT APPLICABLE
10	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	0.0	221.141	NOT APPLICABLE
10	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	0.0	221.141	221.141
10	CHANGE	0.0	0.0	NOT APPLICABLE

Reproduced from best available copy.

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS
****

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
11	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-19.344	94.956	NOT APPLICABLE
11	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	21.363	92.936	92.937
11	CHANGE	2.020	2.020	NOT APPLICABLE
12	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-17733.523	-7014.570	NOT APPLICABLE
12	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-17873.320	-7154.367	-7154.320
12	CHANGE	139.797	139.797	NOT APPLICABLE
13	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-123.717	-29.445	NOT APPLICABLE
13	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-127.683	-33.412	-33.411
13	CHANGE	3.967	3.967	NOT APPLICABLE
14	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	391.431	1175.631	NOT APPLICABLE
14	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	385.871	1170.070	1170.075
14	CHANGE	5.561	5.561	NOT APPLICABLE
15	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-90.804	95.210	NOT APPLICABLE
15	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-101.448	92.566	92.566
15	CHANGE	-2.644	2.644	NOT APPLICABLE

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS
****

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
16	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	159.634	515.390	NOT APPLICABLE
16	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	157.977	513.733	513.734
16	CHANGE	1.657	1.657	NOT APPLICABLE
17	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	318.759	499.178	NOT APPLICABLE
17	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	315.826	496.245	496.246
17	CHANGE	2.933	2.933	NOT APPLICABLE
18	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	124.095	478.501	NOT APPLICABLE
18	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	122.427	476.833	476.833
18	CHANGE	1.668	1.668	NOT APPLICABLE
19	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-17.625	217.337	NOT APPLICABLE
19	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-19.785	215.176	215.177
19	CHANGE	2.161	2.161	NOT APPLICABLE
20	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-533.191	119.091	NOT APPLICABLE
20	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-537.875	114.405	114.407
20	CHANGE	4.684	4.686	NOT APPLICABLE

Reproduced from best available copy.

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS
****

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
21	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-119.301	912.071	NOT APPLICABLE
21	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-145.041	886.331	886.339
21	CHANGE	25.740	25.740	NOT APPLICABLE
22	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	56.094	1016.403	NOT APPLICABLE
22	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	51.048	1011.557	1011.559
22	CHANGE	5.046	5.046	NOT APPLICABLE
23	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	31.157	6.217	NOT APPLICABLE
23	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	29.977	5.037	5.037
23	CHANGE	1.180	1.180	NOT APPLICABLE
24	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	227.097	1393.093	NOT APPLICABLE
24	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	207.405	1373.401	1373.416
24	CHANGE	19.692	19.692	NOT APPLICABLE
25	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	1398.919	5372.410	NOT APPLICABLE
25	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	1363.718	5337.207	5337.230
25	CHANGE	35.201	35.203	NOT APPLICABLE

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
26	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-108.350	318.141	NOT APPLICABLE
26	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-115.173	311.318	311.320
26	CHANGE	6.823	6.823	NOT APPLICABLE
27	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	2390.395	5658.937	NOT APPLICABLE
27	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	2352.236	5620.777	5620.797
27	CHANGE	38.159	38.160	NOT APPLICABLE
28	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	107.377	216.238	NOT APPLICABLE
28	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	104.705	213.565	213.565
28	CHANGE	2.672	2.672	NOT APPLICABLE
29	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	219.997	1243.114	NOT APPLICABLE
29	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	205.655	1228.772	1228.780
29	CHANGE	14.342	14.342	NOT APPLICABLE
30	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	967.812	1266.022	NOT APPLICABLE
30	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	962.311	1260.520	1260.526
30	CHANGE	5.502	5.502	NOT APPLICABLE

Reproduced from best available copy.

NET PRESENT VALUE OF FUTURE CASH FLOW ANALYSIS
****

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
31	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	670.521	1448.669	NOT APPLICABLE
31	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	649.571	1419.719	1419.726
31	CHANGE	20.950	20.950	NOT APPLICABLE
32	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	402.146	1342.772	NOT APPLICABLE
32	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	393.055	1333.680	1333.685
32	CHANGE .	9.091	9.091	NOT APPLICABLE
33	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	891.527	3675.717	NOT APPLICABLE
33	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	853.228	3637.417	3637.427
33	CHANGE	38.299	38.299	NOT APPLICABLE
34	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	2607.374	8023.586	NOT APPLICABLE
34	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	2581.436	7997.645	7997.648
34	CHANGE	25.938	25.941	NOT APPLICABLE
35	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	81.622	241.572	NOT APPLICABLE
35	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	76.754	236.704	236.704
35	CHANGE	4.868	4.868	NOT APPLICABLE

FIRM NAME		HISTORICAL AVERAGE (MILLIONS)	BASELINE FORECAST (MILLIONS)	COMPLIANCE FORECAST (MILLIONS)
36	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	-344.537	-2497.582	NOT APPLICABLE
36	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-348.042	-2501.087	-2501.085
36	CHANGE	3.505	3.505	NOT APPLICABLE
37	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	173.032	490.122	NOT APPLICABLE
37	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	173.032	490.122	490.121
37	CHANGE	0.0	0.0	NOT APPLICABLE
38	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	353.012	1125.050	NOT APPLICABLE
38	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	347.794	1119.832	1119.833
38	CHANGE	5.218	5.218	NOT APPLICABLE
39	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	0.0	849.658	NOT APPLICABLE
39	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	-0.267	849.391	849.391
39	CHANGE	0.267	0.267	NOT APPLICABLE
40	NPV OF FUTURE CASH FLOW- NO COMPLIANCE	731.619	2184.923	NOT APPLICABLE
40	NPV OF FUTURE CASH FLOW- WITH COMPLIANCE	703.819	2157.114	2157.118
40	CHANGE	27.809	27.809	NOT APPLICABLE

Reproduced from best available copy.

RATIO OF NPVFCF TO NET WORTH
****

FIRM	HISTORICAL	BASELINE	FORECAST
****	**********	********	********
1	0.69	3.71	3.71
2	0.69	2.64	2.64
3	0.29	9.31	9.31
4	*	*	*
5	-0.06	1.98	1.98
6	0.62	0.54	0.54
7	-5.31	66.43	66.43
10	*	*	*
11	-0.24	1.08	1.08
12	*	*	*
13	-24.61	-6.44	-6.44
14	1.70	5.16	5.16
15	-2.37	2.17	2.17
16	2.14	6.94	6.94
17	3.53	5.54	5.54
18	0.97	3.77	3.77
19	-0.45	5.00	5.00
20	-1.30	0.28	0.28
21	-0.22	1.35	1.35
22	0.39	7.69	7.69
23	*	*	*
24	0.44	2.90	2.90
25	1.58	6.67	6.67
26	*	*	*
27	1.86	4.45	4.45
28	0.70	1.42	1.42
29	0.89	5.28	5.28
30	3.62	4.74	4.74
31	0.55	1.19	1.19
32	2.14	7.25	7.25
33	0.55	2.34	2.34
34	1.86	5.76	5.76
35	0.90	2.76	2.76
36	*	*	*
37	1.87	5.28	5.28
38	1.55	4.99	4.99
39	*	*	*
40	0.53	1.62	1.62

FIRM	INITIAL COST
1	49.492
2	53.126
3	2.058
4	6.070
5	83.820
6	35.435
7	42.303
10	0.0
11	2.896
12	199.557
13	5.638
14	7.986
15	3.763
16	2.359
17	4.182
18	2.376
19	3.081
20	6.641
21	36.640
22	7.215
23	1.671
24	28.069
25	50.299
26	9.744
27	54.291
28	3.816
29	20.521
30	7.832
31	41.361
32	12.937
33	54.899
34	37.108
35	6.964
36	5.022
37	0.0
38	7.500
39	0.385
40	39.720
TOTAL	936.773

?

Reproduced from best available copy.

1.6 Example of Use of the Cash Flow Model

1.6.1 Introduction

During the economic impact analysis of the proposed railyard noise standards, the cash flow model was used as a tool to identify weak firms and to assess the size of impacts. This section briefly describes the results gained through use of the cash flow model. The complete economic impact analysis can be found in the Background Document to Railyard Noise Standards. Eight regulatory scenarios of possible levels of Field Emission Standards (FES) and Source Emission Standards (SES) were analyzed. They were:

1. Scenario I (FES = 75, SES = 65)
2. Scenario II (FES = 70, SES = 65)
3. Scenario III (FES = 70, SES = 60)
4. Scenario IV (FES = 65, SES = 65)
5. Scenario V (FES = 65, SES = 60)
6. Scenario VI (FES = 60, SES = 65)
7. Scenario VII (FES = 60, SES = 60)
8. Scenario VIII (FES = 55, SES = 60)

These eight regulatory scenarios were also compared to the scenario of no regulation. In general, the cost of the regulation increased as the stringency of the regulations increased from one through eight. This is illustrated in Table 1-2, which shows the initial investment each firm

would need to make to comply with regulation. For example, costs for the Norfolk and Western increase from $6.28 million to $288.52 million as regulatory stringency increases from Scenario I to Scenario VIII. Table 1-2 was generated by running the cash flow model eight times (one for each scenario) and using the results from the "Initial Investment" output of the model.

1.6.2 Interpretation of Model Outputs

As was described in Section 1.2 above, the model's essential function is to calculate the ratio of Net Present Value of Future Cash Flows (NPV) to Net Worth (NW). The following broad categories were used to evaluate firms according to their ratio of NPV to NW.

(a) Weak Firms - If the NPV/NW < 0, the firm is in extremely weak financial condition. Noise abatement expenditures will worsen (if the ratio is < 0 before regulation) or create (if the ratio is < 0 only after regulation) a tenuous financial condition.

(b) Marginal Firms - If 0 < NPV/NW < 0.1 before or after abatement expenditures, then the firm may suffer financial difficulties as a result of regulation. The firm would be extremely sensitive to any downturn in economic activity.

(c) Stronger Firms - If NPV/NW > 0.1 after abatement, the firm has a reasonably sound financial basis. Regulation would not be expected to cause major financial problems.

The interpretation of results focused on:

1. the evaluation category which each firm fell into; and
2. changes in the net present value ratio due to regulation.

TABLE I-2

INITIAL TOTAL INVESTMENT COSTS
(MILLION $)

FIRM	SCENARIO I (75,65)	SCENARIO II (70,65)	SCENARIO III (70,60)	SCENARIO IV (65,65)	SCENARIO V (65,60)	SCENARIO VI (60,65)	SCENARIO VII (60,60)	SCENARIO VIII (55,60)
Alabama Great Southern	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amtrak	0.25	0.40	0.60	1.30	1.47	2.89	2.92	8.92
Atchison, Topeka and Santa Fe	5.79	13.96	15.71	33.70	36.64	82.56	82.79	270.18
Baltimore and Ohio	6.31	14.72	16.88	35.71	38.91	88.33	88.55	292.36
Bessemer and Lake Erie	0.19	0.40	0.45	1.13	1.26	1.26	1.26	9.14
Boston and Maine	0.75	1.59	1.91	3.96	4.45	10.07	10.11	31.38
Burlington Northern	10.04	23.70	26.98	56.70	62.20	139.92	140.32	468.48
Central of Georgia	1.81	2.56	2.78	5.83	6.26	12.98	13.03	48.18
Chesapeake and Ohio	4.09	9.36	10.87	22.52	25.15	58.38	58.51	188.28
Chicago and Northwestern	4.62	10.50	12.19	27.18	29.57	69.36	69.54	217.79
Cinc., New Orl. and Tx. Pac.	0.06	0.13	0.14	0.33	0.34	0.68	0.69	2.42
Clinchfield	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado and Southern	0.35	0.86	0.96	2.16	2.20	4.92	4.94	16.09
Conrail	24.80	57.92	66.18	137.51	151.49	335.89	336.17	1128.16
Delaware and Hudson	0.61	1.30	1.56	3.55	3.87	9.19	9.21	27.48
Denver and Rio Grande Western	1.05	2.67	2.91	6.10	6.55	13.75	13.80	50.57
Detroit Toledo and Ironton	0.49	1.08	1.27	2.48	2.83	6.30	6.32	20.75
Duluth Missabe and Iron Range	0.26	0.57	0.68	1.54	1.67	3.88	3.89	11.92
Elgin, Joliet and Eastern	0.54	1.26	1.44	2.84	3.20	7.04	7.06	24.01
Florida East Coast	0.26	0.60	0.69	1.56	1.68	3.91	3.92	12.35
Ft. Worth and Denver	0.33	0.80	0.89	2.01	2.16	5.07	5.08	16.66
Grand Trunk Western	0.68	1.41	1.72	3.93	4.33	10.68	10.70	30.75
Illinois Central Gulf	4.25	9.65	11.23	23.77	26.30	60.53	60.68	194.20
Kansas City Southern	0.83	2.01	2.24	5.06	5.39	12.06	12.11	40.51
Long Island	0.24	0.52	0.63	1.02	1.26	2.81	2.81	9.44
Louisville and Nashville	3.47	7.79	9.08	18.94	20.90	46.88	47.04	152.83
Missouri Pacific	5.96	14.53	16.25	34.86	37.77	84.26	84.51	287.70
Missouri-Kansas-Texas	1.07	2.65	2.95	6.61	7.06	16.16	16.20	54.19
Norfolk and Western	6.28	14.34	16.66	34.79	38.70	89.54	89.75	288.52
Pittsburgh and Lake Erie	0.44	1.02	1.16	2.63	2.81	6.35	6.37	20.61
St. Louis-San Francisco	2.52	6.18	6.89	14.65	15.85	34.66	34.78	120.57
St. Louis - Southwestern	0.89	2.12	2.42	5.03	5.58	12.93	12.95	42.76
Seaboard Coast Line	5.08	11.67	13.39	29.09	31.53	69.48	69.75	229.58
Soo Line	1.37	3.15	3.64	8.22	8.90	21.13	21.18	66.29
Southern Pacific	7.16	17.73	19.61	40.71	44.17	93.89	94.24	337.27
Southern Railway	5.12	12.12	13.76	27.74	30.80	67.14	67.35	231.92
Union Pacific	4.57	11.23	12.45	26.42	28.65	62.68	62.88	218.71
Western Maryland	0.86	2.15	2.38	4.92	5.37	11.77	11.80	41.72
Western Pacific	0.60	1.47	1.63	3.66	3.88	8.48	8.51	29.15
Total	113.16	266.20	303.26	619.34	701.25	1568.8	1571.54	5250.49

*Source: ERCO estimates.

Reproduced from best available copy.

No attempt was made to rank firms within an evaluation category by their relative strengths or weaknesses although in most cases this would be possible. For example, the relative financial positions of strong firms were not compared using the ratio. The net present value ratio was intended to first, separate out the most vulnerable firms, and second, to allow a measure of noise abatement impacts by firm.

1.6.3 Cash Flow Assumptions

The results of the cash flow modeling was presented in two parts, reflecting alternative formulation of railroad cash flows. The two alternative formulations of the cash flow are as follows:

Historical Analysis: In this analysis, it was assumed that railroad cash flows would be constant over time. The average cash flow for the period 1973-1978 (in constant 1980 dollars) was calculated for each firm. Future cash flows over the time horizon of the project were assumed equal to this historical average.

Derived-Forecast Analysis: In this analysis, railroad cash flows grow over time in proportion to the baseline industry forecast. The analysis of compliance impacts is included by using the results of the profit-maximizing model to estimate changes in cash flow due to regulation. The profit maximizing model is described in the Background Document. Because the baseline forecast projects industry growth over time, some firm finances appear stronger in the derived forecast analysis than in the historical analysis. Other firms become weaker because their increasing costs outweighed increased revenues.

1.6.4 Historical Cash Flow Analysis

An analysis was first carried out in which each firm's cash flow was assumed to remain at its 1973 to 1978 (in 1980 dollars) average. The cash flow stream was assumed to begin in 1980 and to end in 2010. Noise abatement investments were made in 1984.

This historical cash flow model presents conservative estimates of each firm's future cash flow streams. It assumes no growth in earnings during the time horizon of the analysis. At the same time, it presents the effects of regulation without the obfuscation due to the forecasting efforts. In that sense, it is a less complex approach to modeling of financial impacts.

The historical cash flow analysis indicated that under the first seven scenarios, no major weakening of firm finances will occur. Under Scenario VIII, the present value of noise control investment is more than 10 percent of the net worth of all the firms studied, and so will significantly weaken these firms.

A substantial number of firms fell into the weak category under all scenarios. (For weak firms, the NPV/NW is negative.) However, no firms changed categories due to regulation, e.g., none fell from the stronger to the marginal or weak categories. The weak firms included the Boston and Maine, Burlington Northern, Chicago and North Western, Colorado and Southern, Clinchfield, Conrail, Detroit Toledo and Ironton, Delaware and Hudson, Fort Worth and Denver, Grand Trunk Western, Illinois Central Gulf, Long Island, Missouri-Kansas-Texas, and Cincinnati, New Orleans and Texas Pacific railroads. These firms may be considered

financially vulnerable. Regulation will worsen their already poor financial condition.

These weakening effects, as measured by the ratio, are small for Scenarios I (75,65) through V (65,65). Under these scenarios, regulation results in small changes in the NPV/NW ratio. Scenarios VI (60,65) and VII (60,60) result in declines in the NPV/NW ratio of about 0.05 for the weak firms with positive net worth. This means that that regulation would reduce firm discounted cash flow by an amount equal to 5 percent of the net worth of the weak firms. Under Scenario VIII (55,60), the ratio declines by about 0.2 for the larger weak firms (Burlington Northern, Illinois Central Gulf, Detroit, Toledo and Ironton) which means that investment costs would reduce discounted cash flow by 20 percent of the firms' net worth.

The remainder of the Class I firms has post-compliance ratios in excess of 0.25 (the ratio for the Bessemer and Lake Erie) and so may be considered relatively strong financially. Regulation will not imperil these enterprises. The Scenario VIII (55,60) regulatory level, however, causes significant changes in the ratio of NPV/NW. For most firms, the ratio declines by 0.1 to 0.2, which means that after regulation, firm DCF would fall by 10 to 20 percent of the value of the firms' net assets. For Scenarios I-VII, the post-regulatory decline in the ratio of NPV to NW is 0-0.09, depending on the scenario chosen and the firm. The complete results of the historical cash flow analysis are shown in Table 1-3.

TABLE I-3

RATIO OF NET PRESENT VALUE OF FUTURE CASH FLOW TO NET WORTH: CLASS I RAILROAD FIRMS, HISTORICAL CASH FLOW PROJECTION[a]

FIRM	NO REGULATION	POST-COMPLIANCE SCENARIO I (75,65)	SCENARIO II (70,65)	SCENARIO III (70,60)	SCENARIO IV (65,65)	SCENARIO V (65,60)	SCENARIO VI (60,65)	SCENARIO VII (60,60)	SCENARIO VIII (55,60)
Amtrak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alabama Great Southern	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87
Atchison, Topeka and Santa Fe	0.71	0.71	0.71	0.71	0.70	0.70	0.67	0.67	0.57
Baltimore and Ohio	0.73	0.73	0.72	0.72	0.71	0.70	0.66	0.66	0.48
Bessemer and Lake Erie	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.25
Boston and Maine	*	*	*	*	*	*	*	*	*
Burlington Northern	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05	-0.08	-0.08	-0.19
Central of Georgia	1.57	1.57	1.57	1.57	1.56	1.56	1.54	1.54	1.42
Chesapeake and Ohio	0.65	0.65	0.64	0.64	0.63	0.63	0.60	0.60	0.49
Chicago and North Western	-4.25	-4.40	-4.54	-4.60	-4.91	-5.01	-5.96	-5.97	-9.79
Cinc., New Orl, and Tx. Pac.	*	*	*	*	*	*	*	*	*
Clinchfield	*	*	*	*	*	*	*	*	*
Colorado and Southern	-0.22	-0.22	-0.23	-0.23	-0.24	-0.24	-0.26	-0.26	-0.36
Conrail	*	*	*	*	*	*	*	*	*
Delaware and Hudson	-23.85	-23.96	-24.05	-24.10	-24.32	-24.39	-25.08	-25.08	-27.60
Denver and Rio Grande Western	1.72	1.72	1.72	1.72	1.71	1.71	1.69	1.69	1.57
Detroit Toledo and Ironton	-2.31	-2.32	-2.33	-2.33	-2.35	-2.35	-2.41	-2.41	-2.66
Duluth Missabe and Iron Range	2.16	2.16	2.16	2.15	2.15	2.14	2.12	2.12	2.05
Elgin, Joliet and Eastern	3.56	3.56	3.55	3.55	3.54	3.54	3.51	3.51	3.37
Florida East Coast	0.98	0.98	0.98	0.98	0.98	0.98	0.96	0.96	0.92
Ft. Worth and Denver	-0.40	-0.41	-0.42	-0.42	-0.44	-0.44	-0.49	-0.49	-0.68
Grand Trunk Western	-1.29	-1.29	-1.29	-1.29	-1.30	-1.30	-1.31	-1.31	-1.34
Illinois Central Gulf	-0.18	-0.18	-0.19	-0.19	-0.20	-0.21	-0.24	-0.24	-0.39
Kansas City Southern	0.43	0.43	0.42	0.42	0.40	0.40	0.37	0.37	0.21
Long Island	*	*	*	*	*	*	*	*	*
Louisville and Nashville	0.48	0.48	0.47	0.47	0.46	0.45	0.41	0.41	0.25
Missouri Pacific	1.62	1.62	1.61	1.61	1.60	1.59	1.56	1.55	1.37
Missouri-Kansas-Texas	*	*	*	*	*	*	*	*	*
Norfolk and Western	1.89	1.89	1.89	1.89	1.88	1.87	1.85	1.85	1.73
Pittsburgh and Lake Erie	0.72	0.72	0.71	0.71	0.71	0.70	0.69	0.69	0.62
St. Louis-San Francisco	0.94	0.94	0.93	0.93	0.91	0.90	0.85	0.85	0.58
St. Louis-Southwestern	3.64	3.64	3.64	3.64	3.63	3.63	3.61	3.61	3.53
Seaboard Coast Line	0.57	0.57	0.56	0.56	0.56	0.55	0.53	0.53	0.44
Soo Line	2.18	2.18	2.18	2.18	2.16	2.15	2.11	2.11	1.93
Southern Pacific	0.57	0.57	0.57	0.57	0.56	0.56	0.54	0.54	0.42
Southern Railway	0.55	0.55	0.55	0.55	0.54	0.54	0.52	0.52	0.43
Union Pacific	1.88	1.88	1.88	1.88	1.87	1.87	1.85	1.85	1.77
Western Maryland	0.95	0.95	0.94	0.93	0.92	0.91	0.86	0.86	0.68
Western Pacific	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

[a]Source: ERCO estimates.

*Net worth less than or equal to zero in 1978. These firms are considered weak.

N/A - Not available.

N/C - Not classified. Net worth uncertain due to reorganization.

1.6.5 Derived Forecast Cash Flow Analysis

A cash flow analysis was also performed in which the basis for firm cash flows were the pre- and post-compliance net income projections of the "profit-maximizing" forecast model discussed in Section 7.7.2 of the Background Document to Railyard Noise Regulation (EPA, 1981). This model was based upon financial statistics for a single year (1978) and assumed output growth of approximately 2.6 percent a year over the time horizon of the study. As a result, its conclusions were different from those of the historical analysis which was based on 1973 to 1978 average results. Firms which had poorer financial results in 1978 than in the preceeding years sometimes fared worse under the derived forecast analysis than in the historical analysis, because the derived forecast used only 1978 as a base, not six years (1973 to 1978) as did the historical analysis. Many firms had stronger ratios under the derived forecast than under the historical analysis, however, because projected increases in traffic often caused cash flow to increase over time.

Overall, twenty firms were classified as strong by the derived forecast cash flow analysis. Seventeen fell into the weak category. This compares with the classification of twenty-three firms as strong and fourteen as weak by the historical cash flow analysis. Four railroads, the Chesapeake and Ohio, the Louisville and Nashville, the Seaboard Coast Line and the Southern Railway were described as weak under the derived forecast analysis but were classified as strong by the historical analysis. The Fort Worth and Denver rose from the weak category in the historical analysis, to the strong category in the derived forecast analysis.

No firm changed category as a result of regulation.

Table 1-4 shows the ratios of Net Present Value of Future Cash Flows to Net Worth under the baseline derived forecast and after regulation for all eight scenarios.

1.6.6 Summary of Cash Flow Analysis

Twelve firms are classified as weak under both the historical and derived-forecast cash flow analyses. Four additional firms were classified as weak under the derived forecast analysis. One firm was classified as strong by the derived forecast but weak by the historical analysis. The remaining 19 firms were categorized as stronger firms under both modeling approaches. Amtrak was not classified because it does not file R-1 forms and so financial data was not available on the same basis. The Western Pacific was not classified because of uncertainty regarding its reorganization.

The cash flow ratio analysis indicates little tendency for firms to be strongly impacted by the first five scenarios. Scenarios VI, VII, and VIII will weaken firm finances to some degree. The classification of firms into weak and stronger groups is due to the effect of past financial trends and chosen modeling technique is not a result of potential regulation. Compliance investments did not cause any railroad firm to be shifted to a lower category (e.g., from strong to weak). The failure of any railroad firm does not appear likely due solely to the impact of the first seven noise regulation scenarios.

TABLE I-4

RATIO OF NET CASH FLOWS TO NET WORTH, DERIVED FORECAST: CLASS I RAILROADS, 1980-2010[a]

FIRM	NO REGULATION	POST-COMPLIANCE SCENARIO I (75,65)	SCENARIO II (70,65)	SCENARIO III (70,60)	SCENARIO IV (65,65)	SCENARIO V (65,60)	SCENARIO VI (60,65)	SCENARIO VII (60,60)	SCENARIO VIII (55,60)
Alabama Great Southern	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Amtrak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Atchison, Topeka and Santa Fe	0.98	0.98	0.97	0.97	0.97	0.94	0.88	0.88	0.62
Baltimore and Ohio	0.28	0.28	0.26	0.25	0.26	0.20	0.10	0.10	-0.35
Bessemer and Lake Erie	7.17	7.17	7.17	7.17	7.17	7.15	7.11	7.11	7.00
Boston and Maine	*	*	*	*	*	*	*	*	*
Burlington Northern	-0.19	-0.19	-0.20	-0.21	-0.20	-0.23	-0.29	-0.30	-0.57
Central of Georgia	3.68	3.68	3.67	3.67	3.68	3.64	3.57	3.57	3.24
Chesapeake and Ohio	0.59	-0.59	-0.60	-0.60	-0.60	-0.63	-0.68	-0.68	-0.88
Chicago and North Western	34.23	-34.08	-34.63	-34.83	-34.21	-36.43	-40.10	-40.12	-54.09
Cinc., New Orl, and Tx. Pac.	*	*	*	*	*	*	*	*	*
Clinchfield	*	*	*	*	*	*	*	*	*
Colorado and Southern	-0.94	-0.94	-0.95	-0.95	-0.95	-0.98	-1.03	-1.03	-1.20
Conrail	*	*	*	*	*	*	*	*	*
Delaware and Hudson	-53.44	-53.33	-53.57	-53.69	-53.53	-54.40	-56.34	-56.35	-62.09
Denver and Rio Grande Western	2.97	2.97	2.96	2.96	2.96	2.93	2.87	2.87	2.57
Detroit Toledo and Ironton	-0.66	-0.66	-0.68	-0.68	-0.67	-0.74	-0.85	-0.85	-1.36
Duluth Misabe and Iron Range	3.39	3.39	3.38	3.38	3.38	3.35	3.29	3.29	3.06
Elgin, Joliet and Eastern	2.13	2.13	2.11	2.11	2.12	2.07	1.98	1.98	1.58
Florida East Coast	2.39	2.39	2.39	2.39	2.39	2.37	2.34	2.34	2.21
Ft. Worth and Denver	1.55	1.55	1.53	1.52	1.53	1.47	1.36	1.36	0.88
Grand Trunk Western	-0.84	-0.85	-0.86	-0.86	-0.86	-0.87	-0.90	-0.90	-0.99
Illinois Central Gulf	1.43	-1.43	-1.44	-1.45	-1.44	-1.49	-1.58	-1.58	-1.95
Kansas City Southern	2.90	2.90	2.88	2.88	2.89	2.83	2.72	2.72	2.24
Long Island	*	*	*	*	*	*	*	*	*
Louisville and Nashville	-2.10	-2.10	-2.12	-2.12	-2.11	-2.17	-2.28	-2.28	-2.73
Missouri Pacific	3.25	3.25	3.23	3.23	3.24	3.18	3.07	3.07	2.60
Missouri-Kansas-Texas	*	*	*	*	*	*	*	*	*
Norfolk and Western	2.53	2.53	2.51	2.51	2.52	2.48	2.40	2.40	2.11
Pittsburgh and Lake Erie	0.57	0.57	0.56	0.56	0.57	0.54	0.50	0.50	0.34
St. Louis-San Francisco	1.64	1.30	1.28	1.27	1.29	1.20	1.06	1.05	0.38
St. Louis-Southwestern	2.59	2.59	2.58	2.58	2.59	2.56	2.50	2.50	2.20
Seaboard Coast Line	-0.57	-0.09	-0.10	-0.11	-0.10	-0.13	-0.18	-0.18	-0.38
Soo Line	3.76	3.76	3.74	3.73	3.74	3.68	3.55	3.55	3.07
Southern Pacific	-0.43	-0.43	-0.44	-0.45	-0.44	-0.48	-0.53	-0.53	-0.83
Southern Railway	0.57	0.57	0.56	0.56	0.56	0.54	0.50	0.50	0.31
Union Pacific	3.09	3.09	3.08	3.08	3.08	3.05	3.01	3.01	2.79
Western Maryland	1.10	1.10	1.08	1.07	1.08	1.01	0.88	0.88	0.26
Western Pacific	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

[a]Source: ERCO estimates.

*Net worth less than or equal to zero in 1978. These firms are considered weak.

N/A - Data not available on net worth.

N/C - Not classified. Net worth uncertain due to reorganization.

Reproduced from best available copy.

APPENDIX A:

ERRATA SHEETS

1. Replace Section 1.1. on page 1-1 with the following paragraphs.

This document presents a general description of the cash flow model used as a tool during the economic impact analysis of proposed railroad yard noise standards. These standards were under development by the Environmental Protection Agency, Office of Noice Abatement and Control. The EPA was directed to promulgate these regulations by Public Law 92-574, the Noise Control Act. The model was used to assess, on a railroad by railroad basis, the probable financial impacts of yard noise regulation on the Class I American railroads. Eight possible levels of regulation were assessed by the model. It demonstrated that some of the more stringent regulations would have very serious economic impacts on both individual railroads and on the industry as a whole.

The model compares the financial strength of a railroad to its regulatory costs. One regulatory scenario is analyzed at a time. The primary measure of financial strength is the net present value of the firm's stockholder's equity. Net present value (NPV) is essentially a comparison of the rate of return on the firm's stockholder's equity to the market rate of return on capital. When NPV is positive, the firm's stockholder's equity is earning more than it could in an alternative use. When NPV is negative, the firm could earn a greater return on stockholder's equity by liquidating its assets and reinvesting the proceeds elsewhere. The Cash Flow model calculates NPV before and after regulation. If NPV is reduced significantly by regulation, and especially if it is made negative by regulation, then the impact on the firm is large. Conversely, a very small post-regulatory

change in NPV indicates that regulatory impacts are slight. A more complete discussion of NPV is presented in Section 1.2 below.

This document also includes a derivation of the equations used in the model, a list of the data inputs, a sample output of the model and an example of its use in the railyard noise regulation economic impact analysis.

2. Change the second sentence of the second paragraph on page 1-2 from:

"The NW of the firm is the original cost of its net assets less depreciation."

to:

"The NW of the firm is the stockholder's equity of the firm, the book value of its assets less debt."

3. Add this section after the third sentence of the second paragraph on page 1-2:

Cash flow is defined as the sum of a firm's net income, its deferred taxes and its equity in the earnings of affiliates. It is a measure of the cash the firm has available for new investments such as regulatory costs or for disbursal to stockholders. Because cash flow includes sources of cash (i.e., deferred taxes and equity in earnings of affiliates) not included in net income, it is a more accurate measure of the firm's cash income than simple net income.

4. Replace the first paragraph of Section 1.3 on page 1-4 with the following:

The cash flow model operates simply. Figure 1-1 is a schematic representation of its structure. First, data is read in from a number of files. The contents of the data files depend on the regulatory scenarios which the user is analyzing. Next, the model calculates the present value of the firm's future cash flows (DCF) and the present value of costs associated with regulation.

The firm's net worth (NW), defined as its stockholder's equity is then subtracted from DCF. This yields NPV. NPV after regulation is divided by NW to yield the ratio of NPV to NW. This ratio is used to assess the financial strength of the various firms, as was explained above.

5. Insert the following paragraph directly below the second dot point and above the first paragraph on page 1-7.

The formula above was used because it includes all the cash income of a firm (except depreciation) and is therefore an accurate measure of the funds available for disbursal to stockholders. Depreciation is not included because it is assumed that the cash flow from depreciation would be used to replace capital equipment. Net Income (NI) is cash income after all taxes and expenses. Deferred taxes (DEFT) are taxes accrued but not yet paid. They are cash available to the firm but not included in net income. Equity in earnings of affiliates (EQ) is the firm's share in the net income of its affiliates.

6. Replace the PVINV equation at the bottom of page 1-8 with the following:

$$PVINV = \sum_{t=0}^{LIFE} \sum_{j=1}^{i} \frac{COST_{t,j} \, (1 + INFLATION)^{t} \, (1-ITC)}{(1 + DISCOUNT)^{t}}$$

7. Insert this section and Table 1-1 directly above the last paragraph on page 1-12.

Table 1-1 summarizes the outputs of the cash flow model. The first set of outputs are the model parameters, which include several constants used throughout the program but which are changable by the programmer. Next are intermediate results of the program. These provide valuable information about the size of the firm's regulatory costs and the total present value of the firm's cash flows. The third set of outputs is the net worth (NW) of each firm. The fourth set is firm discounted cash flow (DCF) before and after regulation. Next is presented the ratio of the net present value of future cash flow to net worth assuming historical, baseline forecast and revised baseline forecast cash flow. Finally, the present (1980) value of firm specific initial (first year) compliance costs in millions of dollars are presented.

8. Replace Figure 1-1 on page 1-6 with the attached figure.

TABLE 1-1

POSSIBLE OUTPUTS AND THEIR SIGNIFICANCE

OUTPUT	SIGNIFICANCE
Model Parameters	Key constants used during computations. Includes number of firms, discount rate, inflation rate, time horizon of project, number of years after 1980 compliance becomes mandatory, and corporate tax rate.
Intermediate Results	Present Value of Regulatory Capital Investments, Present Value of Regulatory-Related Operating and Maintenance Costs, Present Value of Tax Reductions because of Straight-Line Depreciation of Regulatory Investments, Present Value of Historical Cash Flows, Present Value of Cash Flows based on Baseline Net Income Forecast, Present Value of Cash Flows based on Revised Baseline Forecast of Net Income.
1978 Net Worth Extrapolated to 1980	Net worth of each firm used in NPVFCF to NW ratio. Consists of projection of 1980 net worth based on 1973-1978 net worth.
Net Present Value of Future Cash Flow Analysis	For each firm, the Net Present Value of Future Cash Flows (DCF minus NW) before and after regulation. Three cash flow bases are included: historical, baseline forecast, and revised (post-regulatory) baseline forecast.
Ratio of NPVFCF to Net Worth	The ratio of the Net Present Value of Future Cash Flows (NPVFCF) to Net Worth for each firm. Ratios are calculated based on historical, baseline forecast, and revised baseline forecast assumptions about cash flows. These ratios are for the firm's financial condition after regulation. Rows with an asterisk mean the firm had negative or zero net worth.
Initial Cost	A firm by firm compilation of the initial costs associated with regulation.

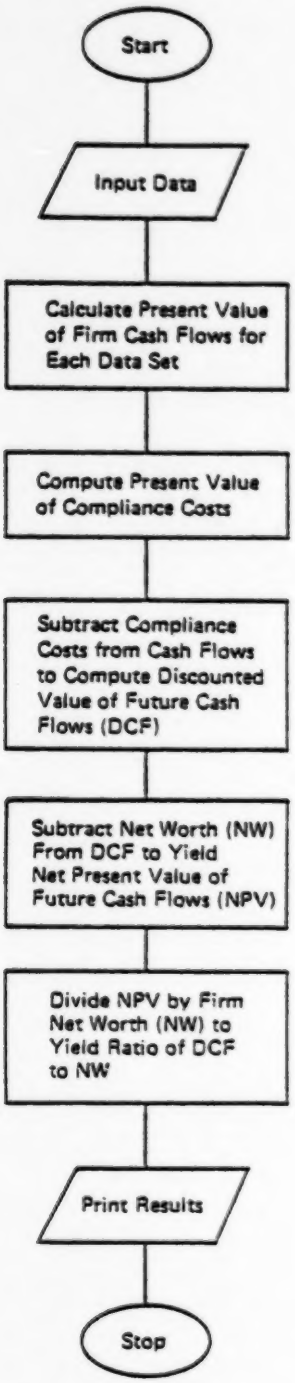
Start
Input Data
Calculate Present Value of Firm Cash Flows for Each Data Set
Compute Present Value of Compliance Costs
Subtract Compliance Costs from Cash Flows to Compute Discounted Value of Future Cash Flows (DCF)
Subtract Net Worth (NW) From DCF to Yield Net Present Value of Future Cash Flows (NPV)
Divide NPV by Firm Net Worth (NW) to Yield Ratio of DCF to NW
Print Results
Stop

Figure 1–1. Flow chart of cash flow model.